
III. *A Letter of Dr* Wallis *to Captain* Edmund Halley; *concerning the Captains* Map *of* Magnetick Variations; *and ſome other things relating to the* Magnet.

Oxford, May 23. 1702.

SIR,

I Sent you a Letter about three weeks ſince, (which, I hope you received,) with my hearty Thanks for the Preſent you had then ſent me; your Map of the *Magnetick Variations.*

I look upon the thing as an Excellent Deſign, and very Inſtructive; well Contrived, and well Executed; And which, I think, was never undertaken by any, before you.

For a true Natural *Hiſtory* of matter of Fact, is certainly the ſureſt Foundation on which to ground a Phyſical *Hypotheſis*, to explain the *Cauſes.*

I am very well pleaſed to ſee, upon the whole, ſo promiſing a Proſpect, as (to me) this ſeems to be.

It fixeth the buſineſs of Magnetick Variation (in theſe Seas) for the *Preſent* Time. If like Obſervations had been made in former Ages, and tranſmitted to us, it would have been of great uſe. But it is now too late to wiſh for that.

If like Obſervations ſhall be made for the Future, from time to time, and Recorded; whereby it may appear, at what Rate the Variation Varies; it will afford a great In-light into the Magnetick Doctrine, of which we are ſo much in the dark.

I hope

I hope you intend to publiſh a *Diſcourſe*, in purſuance of that *Map*, which I ſhall be glad to ſee: Expecting to find, therein, divers conſiderable Remarks, by you obſerved in the Southern Seas; where (perhaps) never any had been, ſo far Southward, as you have been.

The Doctrine of the *Magnet*, hath been moſtly improved at *Greſham* College, (or by thoſe related thereunto, and there converſant,) for an Age or two laſt paſt; as *Blagrave*, *Gunter*, *Gellibrand*, *Gilbert*, *Norwood*, *Wright*, *Brigs*, *Foſter*, *&c.* and (of late) by *yourſelf*. If I have miſtaken ſome Names, or miſplaced them, or omitted others; you will be able to rectifie it.

I have given ſome Intimation of it (but very imperfectly) in a Letter of mine, inſerted in the *Tranſactions* for the Month of *December* 1701. where (beſide divers Literal Faults) they have unhappily miſ-printed 1635, inſtead of 1625.

For it was about the beginning of the Reign of King *Charles* the Firſt, that Mr *Gellibrand* (if I have not been miſ-informed) cauſed the Great *Concave Dial* to be erected in the *Privy Garden* at *White-hall*, (which, I think, is yet remaining;) with great care to fix a true *Meridian-Line*; and with a large *Magnetick Needle*, ſhewing its *Variation*, from that *Meridian*, from time to time.

I think it were not amiſs, if exact Obſervation were now made, whether the *Meridian* be, Now, juſt the ſame as it was Then. • For it is very poſſible, that the *Pole* of the Earth, may, in time, ſuffer ſome little Variation (which may not readily be diſcerned,) which may cauſe an Alteration of the Meridian-Line. And this, if ſo, will be more diſcernible Nearer the Pole, than Farther off.

And though ſuch Proviſion (as was but now ſaid) were made at *White-hall*, for obſerving the Needles Variation from the true North; and, though (no doubt) notice have been given many times (there and elſewhere) what the Variation hath been at ſuch times: Yet, I doubt, no Re-

Regiſter hath been kept of ſuch Obſervations; whence we might form a Scheme, how ſuch Variations do proceed from time to time.

It hath been obſerved alſo, of what they call the *Dipping Needle*; that, (beſide the *Horizontal* Direction toward the North,) it hath alſo a Direction of *Altitude*, above and below the Horizon, if balanced on an Horizontal Axis: Pointing as it were with its Northern end (in our Climate) to ſome Point within the Body of the Earth. Whether or no this Direction do Vary (from time to time) as doth that of its Horizontal Poſition Northward; I cannot tell: nor do I know, whether or no it hath been yet obſerved. Nor, whether or no the Southern End, in other parts of the World, do *Dip*; as the Northern End doth with us. All which things deſerve ſerious Conſideration.

I could wiſh, that you would take ſome pains, (for I know not who can do it better,) by yourſelf, or whom elſe you ſhall think fit to aſſociate, to collect, and give us a brief Hiſtory, of what hath been done in this kind, (how, when, and by whom;) and by what Steps the Doctrine of the *Magnet* hath been gradually promoted: For it is pity the Memory of it ſhould be loſt. And perhaps it may be the laſt Requeſt I may live to beg of you, (being now at the age of 86;) And it is for the Publick, and not for my ſelf.

Or, if it be too great a task for you to undertake at preſent, (who have your hands full of other weighty buſineſs;) I wiſh the Royal Society would ſeriouſly recommend it to the care of ſome other fit perſon, of their Members, who may be Able and Willing to undertake it: As a thing that would be welcome to the Inquiſitive World, would be an Honour to the *Nation*, to *Greſham-College* in particular; and, to the *Royal Society*.

I have (in the Letter above mentioned) given my Conjecture, that the *Mariners Compaſs* (of ſuch prodigious uſe in Navigation) was Originally an *Engliſh* Invention. Not

Not only, becauſe *England* was, at that time, as famous for Navigation as any Nation that I know,(for the *Holland* Sea-trade was not then in Being, nor for a long time after.) But even from the Name of *Mariners Compaſs*, (for what, in *Latin*, is called *Circulus Nauticus.*) For the word *Compaſs*, is an ancient *Engliſh* word, for what we otherwiſe call (by a *French* name) a *Circle.*

And I am ſure that, within my Memory, (in the place where I was Born and Bred,) it was wont to be commonly ſo called, (however, of later times, the word *Circle* is more in uſe.) And, if we conſult *Minſhew's* Dictionary, we ſhall find, that he takes *Circle*, and *Compaſs*, indifferently to ſignifie the ſame with *Circulus.*

And hence it is that *Circinus*, is, in *Engliſh*, called *a Compaſs*, (or *a pair of Compaſſes*,) as being the Inſtrument by which we deſcribe *a Compaſs*, or Circle.

Now I do not know, that the word *Compaſs* then was, (or now is,) in any *other* language, ſo uſed for a Circle *indefinitely*, or for any *other* Circle than the *Circulus Nauticus*. But now, in all Languages, (*French*, *Italian*, *German*, *&c.*) the *Circulus Nauticus* hath the Name of *Compaſs*, (or ſomewhat analogous,) *compaſs*, *compaſſo*, *zee-kompas*, *&c.* Which *Name*, I gueſs, together with the *Art*, they borrowed from *England.*

I might urge the ſame, from another Name, *Boſſolo*, *Boſſola*, *&c.* For, as *Circulus Nauticus* is the Mariners *Compaſs*; ſo *Pyxis Nautica* is the Mariners *Box*, (for the Engliſh *Box* is from the Latin *Pyxis*;) And *Pyxidula* (as a Diminutive from *Pyxis*) muſt be *Boxel* (or ſome word like it,) which eaſily paſſeth into the French *Buxole*, *Bouſſole*; and the Italian *Boſſola*, *Bouſſola*, *Boſſola*; which all ſeem to be from the Engliſh *Boxel* (*Pyxidala*) *a little Box*; ſoftening the ſound of the letter *x* in *ſſ*; as in *Aleſſandro* for *Alexandro.*

All which, though it be not a direct Demonſtration (in the ſilence of Hiſtory;) is at leaſt a Probable *Conjecture*, and a Plauſible *Pretence* to the Invention (till a better claim do appear.) For, in the caſe of *New Inventions*, when they come abroad, they commonly take their *Names*, from whence the Invention itſelf is taken.

And where Inventions creep in by degrees, it muſt not be thought ſtrange, if it be not eaſie to ſay, who is the *Firſt Inventer.*

In the preſent caſe; He who firſt obſerved (I know not by what Accident) that the *Magnet* hath a *Polarity*, or Inclination Northward, made the *Firſt Step* towards this Invention. This (I think) was at firſt wont to be ſhewed, by putting a Magnet into a little Boat, ſwimming on Water, when it was obſerved, that this Magnet would of it ſelf ſo ſteer this little Boat, as that a certain Point in the Magnet would (if not hindered) turn toward the North. Which Point was thereupon called the Magnets *North Pole.*

He that afterward obſerved, that this Verticity, or Polarity, was communicable to a piece of Iron or Steel, rubbed on a Magnet, added a further ſtep toward the buſineſs in hand.

And he who contrived a way to ſet a Needle or piece of Steel (ſo touched) on a ſharp Pin, ſo as (in the Air) to move Horizontally thereon, ſo as (of itſelf) to find out the North, and Point toward it, as (before) the Swimming Magnet (in its Boat) had done on the Water; had now diſcovered a New Experiment, in Natural Philoſophy, very ſurprizing.

But this cannot yet be called *Circulus Nauticus* (or the *Mariners Compaſs*,) till they had further contrived a way, how to put a Needle (thus poiſed) into a Box, with a Compaſs or Circle round it; ſo divided as to denote the Azimuthal Points of the Horizon, (or, as they be now called, the *Points of the Compaſs*;) and ſo commodiouſly to fix this Box (ſo prepared) to the Ship, as thereby to inſtruct the Mariner (or Steers-man) toward what Point of the Compaſs the Ship moved; that (by the help of the Rudder) he might put it into ſuch a courſe, as was pro-

per

per for his Voyage. And it was now indeed *Pyxis Nautica* or *Circulus Nauticus*, (the *Mariners Box* or *Compaſs*,) but not till Then. And he who firſt contrived this Application, did *compleat* this Invention of *Circulus Nauticus*. But all thoſe antecedent Diſcoveries were ſteps towards it, and Parts of the Invention.

Now it is not likely, that all theſe Diſcoveries were made at once (by the ſame Man, at the ſame Time,) but Succeſſively; by the joint Advice of divers Inquiſitive Men, and in a conſiderable tract of Time; yet all perhaps of the ſame Nation, and (probably) the *Engliſh*.

But, whoever gave the firſt Hint of this Invention; certain it is, that the great *Improvements* of the Magnetick Doctrine are due to the *Engliſh*; and chiefly to thoſe about *London*, and *Greſham*-College. And it is fit the Memory of it ſhould be preſerved.

The Caſe is much the ſame with that of *Printing*, which we cannot reaſonably ſuppoſe to be invented all at once; nor perhaps all by the ſame Man; But rather, by the concurrent advice of divers, and in a conſiderable tract of time, before it come to that degree of Perfection, which we now call *Printing*.

It might be firſt obſerved, that the ſhape of a Letter, Figure or Picture, graved on Wood or Metal, might (with help of a convenient preparation of Oil, Ink, or coloured Liquor) be ſtamped on Paper. And, if once, then as oft as you pleaſe.

And, if by ſtamping the Print on Paper, then (as well) by due application of the Paper to the Print, thus prepared.

And, if one, then (by the ſame reaſon) to two or more (if fitly conjoined) and even to a whole Page at once: and, of that, as many Copies as we pleaſe.

But (this being admitted) it remains further, to be contrived, how all theſe Prints or Stamps (for a whole Page) ſhall be ſo compoſed into one Frame, that the Paper may be applied to all at once.

It is then to be conſidered further, what kind of *Ink* (or ſomewhat inſtead of Ink) is to be applyed to the Face of the Letters thus compoſed. For common Writing-Ink will not ſerve the turn.

Then, How the Paper ſhall be applyed (with an Equal preſſure, and ſufficient) ſo as to take off juſt ſo much of that Ink, as repreſents the Face of thoſe Letters, and no more.

And, after all this, it muſt be further contrived, How to erect ſuch a Structure, as what we now call a *Printing-Preſs*: and, How to manage it, ſo as to anſwer all theſe Exigences. For, till all this be done, we are not arrived at what we call *Printing*. But all thoſe previous Contrivances, muſt be owned as *Parts* of the *Invention*.

And, in the *Magnetick Doctrine* likewiſe. And, to thoſe *previous* Diſcoveries, muſt be added, the *Subſequent* Improvements of Magnetick Knowledge, ſince the firſt *uſe* of the *Mariners Compaſs*. But of this enough.

I underſtand, you are engaged alſo in the buſineſs of the *Tides*, and the *Soundings* in our *Engliſh* Seas (and to very good purpoſe,) as well as the *Magnetick Variations*. Of which the one may poſſibly be ſubſervient to the other.

You may perhaps think fit, (in order thereunto,) to caſt your Eye on my Hypotheſis, *De Æſtu Maris*. Which, though a ſhort Eſſay, and publiſhed long ſince, (and but from a moderate knowledge of the Hiſtory of Tides;) contains (I think) much of Truth in it; and is capable of being Poliſhed, by thoſe who are better acquainted with the Hiſtory of Tides, than I pretend to be. For I look upon theſe *Hypotheſes* as highly probable, which do naturally follow from the general *Laws of Motion* duly conſidered. And I cannot but think, that, as well the *Courſe* and *Variation* of *Tides*; as the *Breezes* and *Trade-Winds* in ſeveral parts of the World; and the *Currents* on ſeveral Coaſts, with their *Annual Viciſſitudes* at ſeveral times of the year; do all depend, in great meaſure, on the *Earths Motion*, with that of the *Moon* (its Attendant,) and the *Compound Motion* of Both, with their *Common Center of Gravity*.

But I would not prejudice your ſpeculations; who may have reaſon to ſuſpect alſo ſome *Inteſtine* Motion within the Body of the Earth, of which we are not well aware.

S I R,

Yours to ſerve you,

John Wallis.